
MINI REVIEW

Nitrogen Retention, Removal, and Saturation in Lotic Ecosystems

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ABSTRACT

Increased nitrogen (N) loading to lotic ecosystems may cause fundamental changes in the ability of streams and rivers to retain or remove N due to the potential for N saturation. Lotic ecosystems will saturate with sustained increases in the N load, but it is unclear at what point saturation will occur. Rates of N transformation in lotic ecosystems will vary depending on the total N load and whether it is an acute or chronic N load. Nitrogen saturation may not occur with only pulsed or short-term increases in N. Overall, saturation of microbial uptake will occur prior to saturation of denitrification of N and denitrification will become saturated prior to nitrification, exacerbating increases in nitrate concentrations and in N export downstream. The rate of N export to downstream ecosystems will increase proportionally to the N load once saturation occurs. Long term data sets showed that smaller lotic ecosystems have a greater capacity to remove instream N loads, relative to larger systems. Thus, denitrification is likely to become less important as a N loss mechanism as the stream size increases. There is a great need for long-term studies of N additions in lotic ecosystems and clear distinctions need to be made between ecosystem responses to short-term or periodic increases in N loading and alterations in ecosystem functions due to chronic N loading.

Key words: nitrogen cycle; lotic ecosystems; nitrogen loading; nitrogen retention; denitrification; primary production; nitrification.
